IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/471,659	Confirmation No.	7775
Applicant	:	Clark, Jr. et al.		
Filed	:	12/24/1999		
TC/A.U.	:	2634		
Examiner	:	Odom, Curtis B.		
Docket No.	:	59.0021		

DECLARATION OF DR. LLOYD D. CLARK (37 CFR 1.132)

Dr. Lloyd D. Clark hereby declares that:

I am one of the co-inventors in the above-identified patent application.

I have a Ph. D. degree in Electrical Engineering from the Massachusetts Institute of Technology. I also have Masters and Bachelor of Science degrees in Electrical Engineering from the Massachusetts Institute of Technology.

From 1990 through 2003 I was employed by Schlumberger Technology Corporation, and worked in the field of well-logging technology, and more specifically, worked in the field of well-logging wireline telemetry for at least 10 years. Since 2004 I have been employed by Ticom Geomatics, Austin, Texas, USA and have been working in the field of Wireless Geolocation.

I have acquired extensive expertise in Discrete Multi-Tone communication through my employment.

I am the inventor on two issued patents in the field of well-logging wireline telemetry (U.S. Patent Number 5,483,232, granted 1996 and U.S. Patent

Number 5,736,936, granted 1998) and I am the author of two published peer-reviewed papers in the field of well-logging wireline telemetry.

I am familiar with the above-referenced patent application, and have reviewed the prior art cited by the Examiner therein, as well as the reasons for rejection of the claims in that application stated by the Examiner. I believe that the claimed invention is not obvious for the following reasons.

In regard to the general statements made by the Examiner in the *Response to Arguments* section

In regard to the general statements made by the Examiner in the *Response to Arguments* section of the Office Action (Page 2), I note the following statements:

> "DMT does not recognize the environment to which it is implemented (in other words, the environment does not affect the process of DMT modulation)."

That statement is incorrect in view of the state of the digital telemetry art as of December 24, 1999. The physical environment is one of the major challenges to digital telemetry in wireline well-logging applications. High temperatures, such as those encountered when exploring petroleum wells drilled deep into the earth's crust, are known to affect the attenuation of signals over the transmission medium. Furthermore, equipment used in wireline well-logging has to take into account the mechanical requirements of the wireline cable, notably the requirement to support the weight of the cable itself and the tools attached thereto. Therefore, the wireline cable may not be the ideal medium for a particular type of

digital data communication. Additionally, the design requirements for a wireline telemetry system for well-logging require cable lengths of at least 30,000 feet as petroleum wells are often at least that long.

A person of ordinary skill in the art of digital communication would not expect success to come from applying known DMT techniques in wireline telemetry systems for well-logging. In 1998 Schlumberger performed a series of tests using DMT-based ADSL modems purchased from Aware, Inc. I was the principal investigator carrying out these experiments. These tests investigated the performance of DMT-based ADSL modems when applied to the well-logging environment. These experiments demonstrated that DMT-based ADSL modems could not establish a communications link when used over a 30,000-foot length of well-logging wireline cable. Any person trying to adapt DMT techniques from ADSL would encounter similar difficulties.

In regard to Claims 21, 22, 24, 25, 28, 29, 31, and 32 as unpatentable over Matsumoto and In regard to Claim 23 as unpatentable over Matsumoto in view of Rasmussen

In regard to the rejection of Claims 21, 22, 24, 25, 28, 29, 31, and 32 as unpatentable over Matsumoto (U.S. Pat. No. 6,522,731, hereinafter Matsumoto), I note the following statements made by the Examiner:

> "It would have been obvious to one of ordinary skill in the art at the time the invention was made that since it is well known that DMT modulation can be used in the presence of cables, the method of

Matsumoto could have been implemented in a well-logging environment." (Office Action, Page 4, lines 6-9).

In regard to the rejection of Claim 23 as unpatentable over Mastsumoto in view of Rasmussen U.S. Patent No. 4,490,788), I note the following statements made by the Examiner:

"Rasmussen discloses acquiring well-log data from a well-logging tool while concurrently receiving transmissions signals. Rasmussen discloses implementing a large number of processing systems which allow multiple functions to be performed simultaneously and the measurement of well-logging systems to be executed concurrently with the processing of these measurements. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the method of Matsumoto could have been implemented to execute concurrently with step of acquiring well-logging data in a well-logging environment as taught by Rasmussen. By executing these steps simultaneously in a well-logging environment, the processing speed in the well-logging device would be increased."

These statements are incorrect, in view of the data communications art as of December 24, 1999. One skilled in the art would not have made the modifications to Matsumoto that would yield the claimed invention, for the following reasons:

The claimed invention recites "operating a well-logging telemetry system ... transmitting a known signal on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit ... using [a] signal-to-noise ratio measurement to determine the number of bits-per-constellation to use for each

carrier [based on a signal-to-noise ratio measurement at the uphole telemetry unit]; and populating a bits-per-carrier table with the bits-per-constellation value for each carrier."

Matsumoto describes DMT as implemented for ADSL, wherein the band of 30 kHz to 320 kHz represents the up multicarrier wave for ADSL communication and the band of 30 kHz to about 1.1 MHz represents the down multicarrier wave for ADSL communication. This technique only works on telephone cables up to lengths of approximately 18,000 feet, and fails completely on well-logging cables that are 30,000 feet long.

Matsumoto deals with solving problems that may occur in telephony art. The invention deals with the transmission of data on a plurality of carriers on a wireline used in well-logging telemetry systems. Matsumoto does not teach the use of the techniques described therein in a well-logging telemetry system. Thus, at least one modification to Matsumoto required to yield the claimed invention would be the introduction of a downhole telemetry cartridge. Considering that Matsumoto teaches a solution to a problem encountered in the telephony art, a person of ordinary skill in the art would not be motivated to modify Matsumoto in such a fashion.

Furthermore, Matsumoto solves problems that are associated with using a telephone line simultaneously for data communication and audio communication. To modify Matsumoto to operate in the well-logging environment, i.e., transmitting a known signal on each of a plurality of carriers from a downhole telemetry cartridge, would render Matsumoto unsatisfactory for its intended purpose of being useful for simultaneous audio and data communication.

Matsumoto's invention solves the problem of quickly adapting to an on-hook/off-hook telephone line but does not provide the slightest suggestion as to how to make the system work on a cable length of 30,000 feet. Persons skilled in the art of ADSL would be aware of the limitations of ADSL techniques and would not expect these techniques to be successfully applied to well-logging wireline telemetry.

As previously stated above, Matsumoto deals with solving problems that one may encounter in the telephony art andoil well operations are very different from those encountered in telephony. The cables are longer than the maximum station-to-station distances used in telephony, the operating temperatures are vastly higher, the pressures are also much higher, the cables are not of the same design as that found in telephony, etc. Because these differences are very significant in the operation of data communications equipment and methodologies, one would not have expected to have success in applying Matsumoto's telephony-related invention for use in wireline well-logging operations.

In regard to Claim 26 as unpatentable over Bae and in regard to Claim 36 as being unpatentable over Bae in view of Van Kerchove

In regard to the rejection of Claim 26 as unpatentable over Bae et al. (U.S. Pat. No. 5,832,387, hereinafter Bae), I note the following statements made by the Examiner:

"However, Bae et al. does disclose the current method can be implemented into any transmission system adopting a multicarrier method (column 1, lines 7-13) including those systems in which a wireline cable is used as the

propagation medium (column 2, lines 17-39). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that since it is well known that multicarrier modulation can be used in the presence of cables, the method of Bae et al. could have been implemented in a well-logging environment." Office Action, Page 9, lines 1-7.

In regard to the rejection of Claim 36 as unpatentable over Bae et al. in view of Van Kerchove (U.S. Patent No. 5,812,599), I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the multicarrier transmission method of Bae et al. with the teachings of Van Kerchove since Van Kerchove states that his method allows the global capacity of the carriers to be enlarged and maximized the minimum additional noise margins amongst the carriers which renders data transmission less sensitive for noise." These statements are incorrect, in view of the data communications art as of December 24, 1999. One skilled in the art would not have made the modifications to Bae that would yield the claimed invention, for the following reasons:

Claim 26 recites, for example, "transmitting a signal of known power level on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit" wherein the preamble indicates that these form part of a well-logging telemetry system.

From the premise that a technique can be used in the presence of cables it does not follow that the same technique can be used in all uses of cables. As

with Matsumoto, Bae describes DMT as implemented for ADSL. Bae does not teach or suggest adapting the teachings of Bae in a well-logging environment. As noted above ADSL techniques do not readily work in a well-logging environment. A person of ordinary skill in the art would at the time of the invention be aware of the limitations of ADSL and would not be motivated to adapt ADSL prior art references, such as Bae, to work in a well-logging environment.

Furthermore, Bae states that "the ADSL system is new technology in which a conventional copper wired line can be used without modification and the signal can be transmitted to subscribers within a range of 3-4 km without any repeater." Bae, Col. 2, lines 21-24. 3-4 km corresponds to a range of approximately 10,000 – 13,000 feet. Petroleum oil wells are often drilled to a length exceeding 30,000 feet. Thus, a person of ordinary skill would realize that such systems do not meet the requirements faced by the petroleum exploration industry and, therefore, would not be motivated to modify Bae to be used in well-logging telemetry.

Van Kerchove, like Matsumoto and Bae, describes DMT as implemented for ADSL. While Van Kerchove mentions that the techniques described therein can be used in other DMT applications, e.g., Orthogonal Frequency Division Mutliplexing (OFMD) (Van Kerchove, Col. 15, lines 39-42), no teaching or suggestion of how to extend DMT to such domains, or to the well-logging environment is disclosed in Van Kerchove. As with Bae and Matsumoto, a person skilled in the art would know of the limitations of ADSL technology and would therefore not be motivated to apply Van Kerchove to wireline telemetry systems for well-logging.

In regard to Claims 8, 12, 13, 20 and 30 as unpatentable over Gardner in view of Isaksson and In regard to Claims 2-7 and 9 as unpatentable over Gardner in view of Isaksson and further in view of Baird

In regard to the rejection of Claim 8, 12, 13, 20 and 30 as unpatentable over Gardner et al. (U.S. Pat. No. 5,832,387, hereinafter Gardner [note that the spelling as used by the Examiner, Gardener, is incorrect]) in view of Isaksson , I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Isaksson et al. because DMT modulation divides the frequency band into discrete subchannels, which allows transmitter to avoid the noisy channels and maximize the bit rate using the best subchannels. It would also have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmission power control logic of Isaksson et al. to control transmission power level of each carrier at the transmitter by measuring signal-to-noise ratio at the receiver to produce a more reliable transmission signal from the receiver when transmission power is increased and to decrease power consumption when transmission power is decreased."

In regard to the rejection of Claim 2-7, and 9 as unpatentable over Gardner in view of Isaksson and further in view of Baird, I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the teachings of Baird et al. into the device of Gardener et al. and Isaksson et al. in order to avoid using separate cables to transmit each signal which reduces the cost and increases the reliability of the device."

These statements are incorrect in view of the state of the art of wireline telemetry for well-logging applications as of December 24, 1999 for the following reasons:

First, one skilled in the art would not have applied Isaksson's transmitter and receiver logic to Gardner because Gardner is a single-carrier communications system for well-logging cables. Gardner does not suggest using multi-carrier communications systems. Therefore, the person of ordinary skill in the art would not look to techniques found in multi-carrier systems like Isaksson's for the purpose of enhancing Gardner.

Second, Isaksson describes a DMT system as implemented in a multi-carrier system for the installed copper network. This system provides transmission over copper cables up to a length of 1300 meters. Baird specifically discloses that the cable therein is typically five or more miles (i.e., 26,400 feet or approximately 8,000 meters) (Baird, Col. 5, lines 1-2), which is consistent with oil-field use. Isaksson's system would fail completely if applied to cables of 30,000 feet (approximately 10,000 meters, i.e., an order of magnitude longer than those used by Isaksson) or even 26,400 feet (~8,000 meters). Therefore, a person of ordinary skill familiar with Isaksson would not seek to extend its use to the well-logging realm, e.g., by combining the teaching of Isaksson with Baird or Gardner.

Third, the Examiner's statement is illogical from the perspective of Gardner in that Gardner docs not deal with multi-carrier communication. Therefore, it would be impossible to "avoid the noisy channels and maximize the bit-rate using the best subchannels" because Gardner has but one channel and thus no subchannels.

Fourth, Isaksson's system for controlling the power level of each carrier presumes that there is more than one carrier. As noted, Gardner is a single-carrier system. Therefore, it would not be useful to modify Garner with Isaksson's system for controlling power level on each carrier when there is only a single carrier, as it would be unnecessary to add logic which would allow manipulation of power on multiple carriers). Baird also is a single-carrier system with respect to each propagation mode. Therefore, it would also not be useful to modify Baird with Isaksson's system for controlling power level on each carrier.

Fifth, Baird deals explicitly with the multiple transmission modes available on a wireline heptacable, specifically for providing power on a logging cable. For example, Baird states that "[i]n a preferred embodiment, cable 20 is a seven-conductor logging cable such as that which is obtainable from various companies [sources omitted]" (Baird, Col. 4, lines 33-35). As I have stated hereinabove, Isaksson describes a system DMT as implemented in a multi-carrier system for the installed copper network. The installed copper network does not use seven-conductor cables. It would therefore not be logical to apply Baird's power delivery system. Logging tools require relatively large amounts of power. Therefore, power-delivery is one of the many challenges in well-logging applications. However, the power-delivery of power used to power logging tools should not be confused with transmission power for data communication, such as that discussed by Isaksson.

Baird explicitly states that it provides "a system and method for ... providing up to 1800 watts to downhole equipment over existing logging cables" (Abstract). That kind of power-delivery is not one of the purposes of the installed copper network for telephony discussed in Isaksson. Furthermore, the installed copper-network of Isaksson is not suitable for high-power delivery. Placing 1800 watts on such a network would certainly not be possible.

In regard to Claims 14, 15, 33-35 as unpatentable over Gardner in view of Matsumoto and In regard to Claims 16 and 17 as unpatentable over Gardner in view of Matsumoto and in further view of Tzannes

In regard to the rejection of Claim 8, 12, 13, 20 and 30 as unpatentable over Gardner in view of Matsumoto, I note the following statements made by the Examiner:

DMT modulation causes transmission of the bitstream as analog signals on a plurality of carrier frequencies. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Matsumoto because DMT modulation divides the frequency band into discrete subchannels, which allows transmitter to avoid noisy channels and maximize the bit rate using the best subchannels."

In regard to the rejection of Claim 16 and 17 as unpatentable over Gardner in view of Matsumoto and further in view of Tzannes, I note the following statements made by the Examiner:

"It would have been obvious to one skilled in the art at the time the invention was made to modify the apparatus of Gardener et al. and Matsumoto with the teachings of Tzannes et al. since Tzannes et al. states that in order for the receiver to correctly interpret the received data, both the first device and the second device must use the same bits-per-carrier table."

These statements are incorrect in view of the state of the art of wireline telemetry as of December 24, 1999 for the following reasons:

First, Matsumoto describes DMT as implemented for ADSL, wherein the band of 30 kHz to 320 kHz represents the up multicarrier wave for ADSL communication and the band of 30 kHz to about 1.1 MHz represents the down multicarrier wave for ADSL communication. This technique only works on telephone cables up to lengths of approximately 18,000 feet, and fails completely on well-logging cables that are 30,000 feet long. A person of ordinary skill in the art would therefore not look to be able to use the techniques used in Matsumoto with the well-logging telemetry system of Gardner.

Second, one skilled in the art would not have applied Isaksson's transmitter and receiver logic to Gardner because Gardner is a single-carrier communications system for well-logging cables. Gardner does not suggest using multi-carrier communications systems. Therefore, the person of ordinary skill in the art would not look to techniques found in multi-carrier systems like Matsumoto for the purpose of enhancing Gardner.

Third, the Examiner's statement makes no sense from the perspective of Gardner in that Gardner does not deal with multi-carrier communication.

Therefore, it would make no sense to "avoid the noisy channels and maximize the bit-rate using the best subchannels" because Gardner has but one channel and thus no subchannels. It would be impossible to select from that which does not exist.

Furthermore, I note the Examiner's statement that:

"The utilization of multiple carriers allows more data to be transmitted with an increase in transmission rate. Therefore, it would have also been obvious to one of ordinary skill in the art to take advantage of DMT modulation rather than a single carrier modulation method."

This is incorrect in view of the state of the art of wireline telemetry as of December 24, 1999 for the following reasons:

At that time (December 24, 1999) there was no prior art example of using DMT in a well-logging telemetry system. The use of multiple carriers, while increasing the transmission rate, has associated therewith many limitations. It would be incorrect to presume that DMT may be readily applied over a particular transmission medium. For example, as I have noted herein above, the techniques of Matsumoto and Bae would fail if applied on cables of great length regularly encountered in well-logging operations. The challenges of applying DMT-based ADSL techniques, e.g., Matsumoto or Bae, in the well-logging environment was further demonstrated by the experiments described hereinabove. Therefore, a person of ordinary skill in the art would not readily apply DMT modulation in such an environment.

Because of the difficulties in deploying DMT modulation successfully, a person of ordinary skill in the art would not expect success to come from applying known DMT techniques in wireline well-logging telemetry systems.

I further declare that all statements made herein of my own knowledge are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Dr. Lloyd D. Clark

Dr. Lloyd D. Clark

December 9, 2005

Date